CHAPTER 12 Aggregate Demand in the Open Economy

Questions for Review

1. In the Mundell–Fleming model, an increase in taxes shifts the IS^* curve to the left. If the exchange rate floats freely, then the LM^* curve is unaffected. As shown in Figure 12–1, the exchange rate falls while aggregate income remains unchanged. The fall in the exchange rate causes the trade balance to increase.

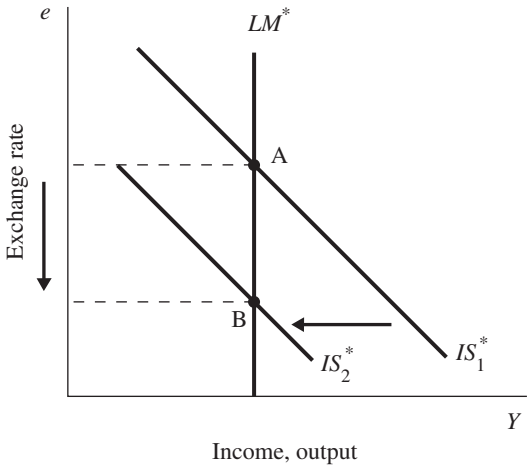


Figure 12–1

Now suppose there are fixed exchange rates. When the IS^* curve shifts to the left in Figure 12–2, the money supply has to fall to keep the exchange rate constant, shifting the LM^* curve from LM^*_1 to LM^*_2. As shown in the figure, output falls while the exchange rate remains fixed.

Net exports can only change if the exchange rate changes or the net exports schedule shifts. Neither occurs here, so net exports do not change.

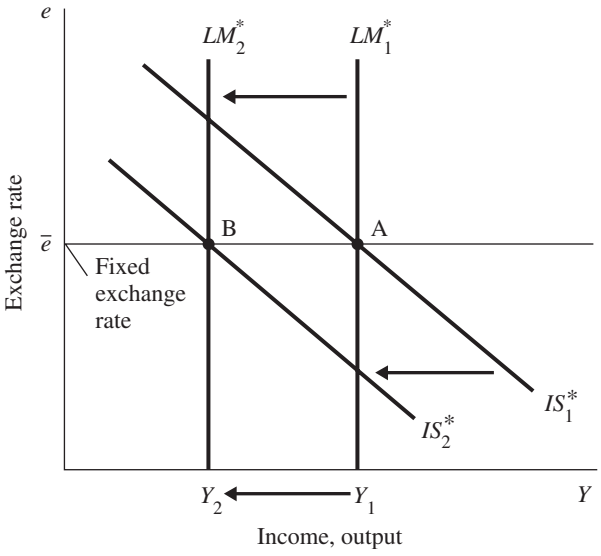


Figure 12–2

We conclude that in an open economy, fiscal policy is effective at influencing output under fixed exchange rates but ineffective under floating exchange rates.

2. In the Mundell–Fleming model with floating exchange rates, a reduction in the money supply reduces real balances M/P, causing the LM^* curve to shift to the left. As shown in Figure 12–3, this leads to a new equilibrium with lower income and a higher exchange rate. The increase in the exchange rate reduces the trade balance.

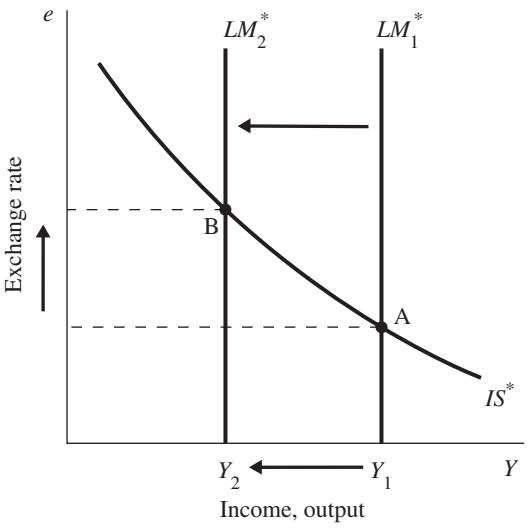


Figure 12–3

If exchange rates are fixed, then the upward pressure on the exchange rate forces the Fed to sell dollars and buy foreign exchange. This increases the money supply M and shifts the LM^* curve back to the right until it reaches LM_1^* again, as shown in Figure 12–4.

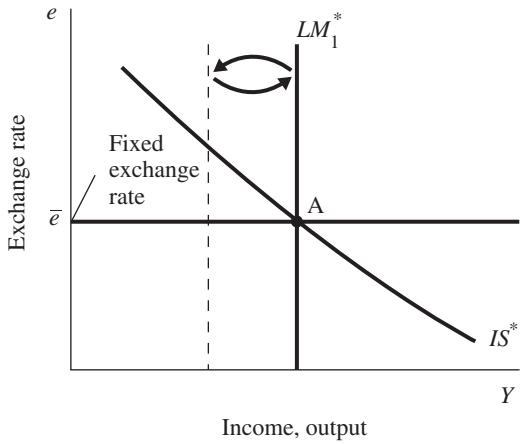


Figure 12–4

In equilibrium, income, the exchange rate, and the trade balance are unchanged.

We conclude that in an open economy, monetary policy is effective at influencing output under floating exchange rates but impossible under fixed exchange rates.

3. In the Mundell–Fleming model under floating exchange rates, removing a quota on imported cars shifts the net exports schedule inward, as shown in Figure 12–5. As in the figure, for any given exchange rate, such as $\bar{e}$, net exports fall. This is because it now becomes possible for Americans to buy more Toyotas, Volkswagens, and other foreign cars than they could when there was a quota.

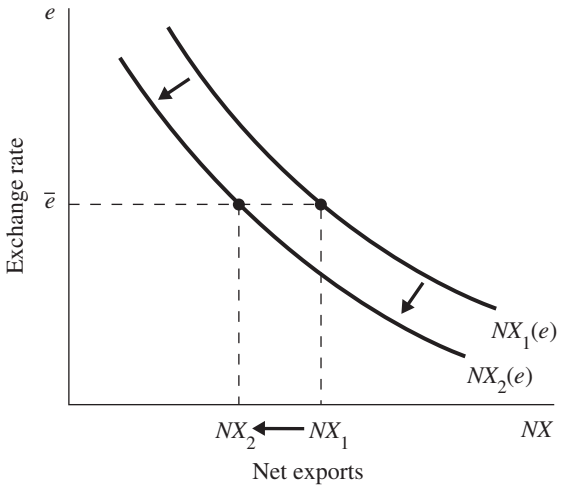


Figure 12–5

This inward shift in the net-exports schedule causes the IS^* schedule to shift inward as well, as shown in Figure 12–6.

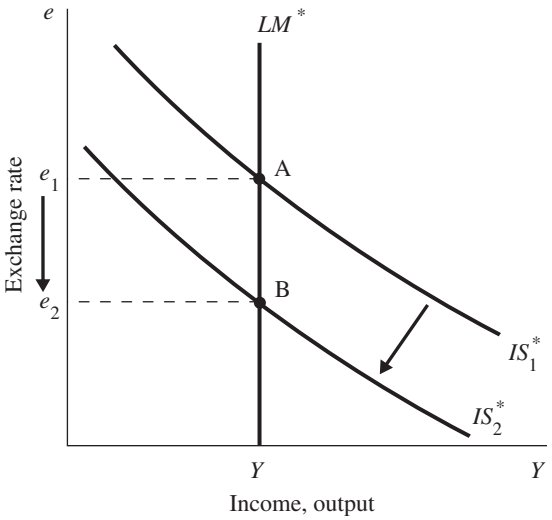


Figure 12–6

The exchange rate falls while income remains unchanged. The trade balance is also unchanged. We know this since

$$NX(e) = Y - C(Y - T) - I(r) - G.$$

Removing the quota has no effect on Y, C, I, or G, so it also has no effect on the trade balance.

If there are fixed exchange rates, then the shift in the IS^* curve puts downward pressure on the exchange rate, as above. In order to keep the exchange rate fixed, the Fed is forced to buy dollars and sell foreign exchange. This shifts the LM^* curve to the left, as shown in Figure 12–7.

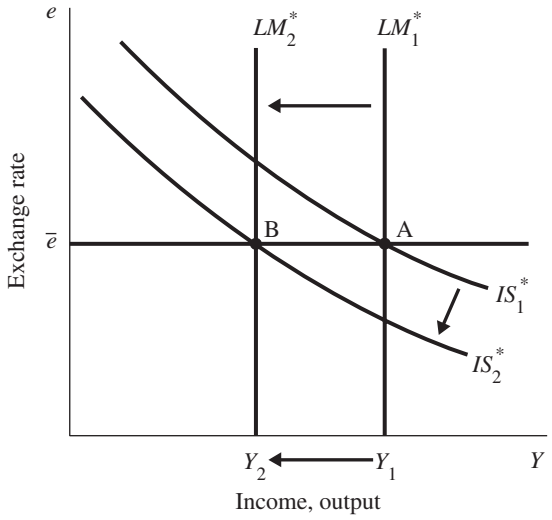


Figure 12–7

In equilibrium, income is lower and the exchange rate is unchanged. The trade balance falls; we know this because net exports are lower at any level of the exchange rate.

4. The following table lists some of the advantages and disadvantages of floating versus fixed exchange rates.

Table 12–1

Floating Exchange Rates	
Advantages:	Allows monetary policy to pursue goals other than just exchange-rate stabilization, for example, the stability of prices and employment.
Disadvantages:	Exchange-rate uncertainty is higher, and this might make international trade more difficult.
Fixed Exchange Rates	
Advantages:	Makes international trade easier by reducing exchange rate uncertainty. It disciplines the monetary authority, preventing excessive growth in M. As a monetary rule, it is easy to implement.
Disadvantages:	Monetary policy cannot be used to pursue policy goals other than maintaining the exchange rate. As a way to discipline the monetary authority, it may lead to greater instability in income and employment.

Problems and Applications

1. The following three equations describe the Mundell–Fleming model:

$$Y = C(Y - T) + I(r) + G + NX(e). \qquad (IS)$$
$$M/P = L(r, Y). \qquad (LM)$$
$$r = r^*.$$

In addition, we assume that the price level is fixed in the short run, both at home and abroad. This means that the nominal exchange rate e equals the real exchange rate ϵ.

a. If consumers decide to spend less and save more, then the IS^* curve shifts to the left. Figure 12–8 shows the case of floating exchange rates. Since the money supply does not adjust, the LM^* curve does not shift. Since the LM^* curve is unchanged, output Y is also unchanged. The exchange rate falls (depreciates), which causes an increase in the trade balance equal to the fall in consumption.

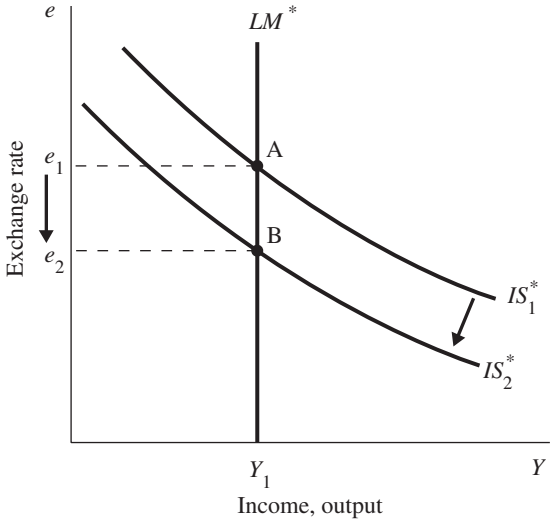


Figure 12–8

Figure 12–9 shows the case of fixed exchange rates. The IS^* curve shifts to the left, but the exchange rate cannot fall. Instead, output falls. Since the exchange rate does not change, we know that the trade balance does not change either.

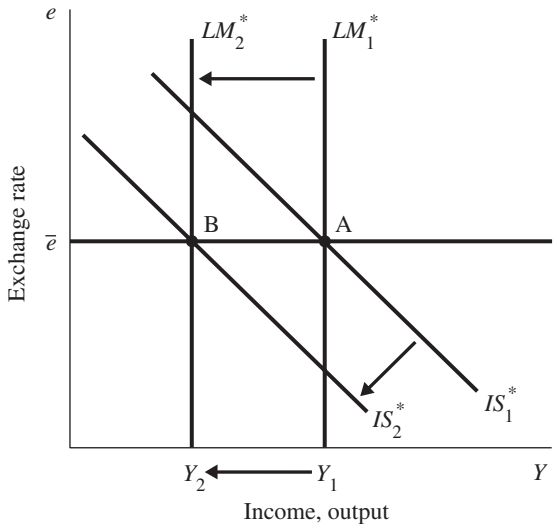


Figure 12–9

In essence, the fall in desired spending puts downward pressure on the interest rate and, hence, on the exchange rate. If there are fixed exchange rates, then the central bank buys the domestic currency that investors seek to exchange, and provides foreign currency. As a result, the exchange rate does not change, so the trade balance does not change. Hence, there is nothing to offset the fall in consumption, and output falls.

b. If some consumers decide they prefer stylish Toyotas to Fords and Chryslers, then the net-exports schedule, shown in Figure 12–10, shifts to the left. That is, at any level of the exchange rate, net exports are lower than they were before.

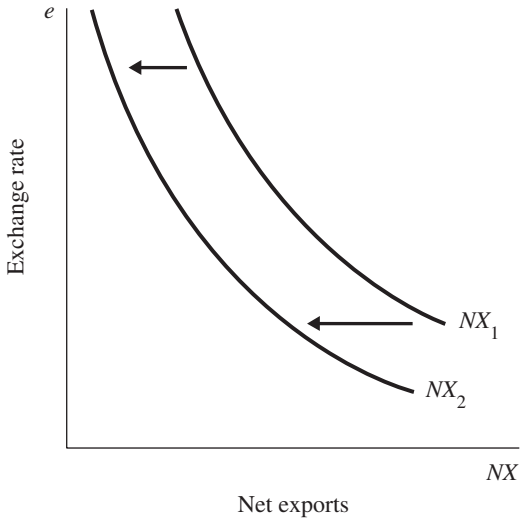


Figure 12–10

This shifts the IS^* curve to the left as well, as shown in Figure 12–11 for the case of floating exchange rates. Since the LM^* curve is fixed, output does not change, while the exchange rate falls (depreciates).

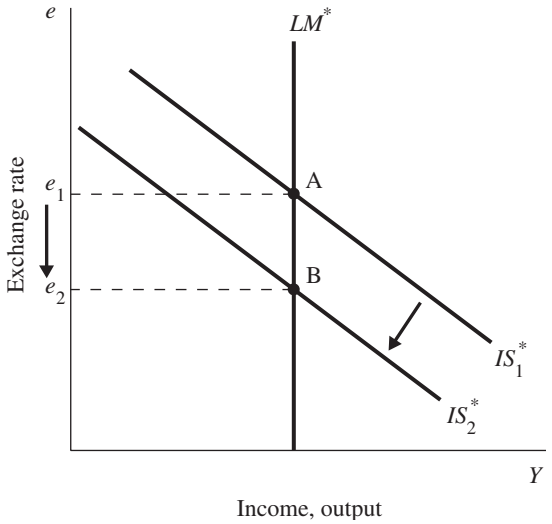


Figure 12–11

The trade balance does not change either, despite the fall in the exchange rate. We know this since $NX = S - I$, and both saving and investment remain unchanged.

Figure 12–12 shows the case of fixed exchange rates. The leftward shift in the IS^* curve puts downward pressure on the exchange rate. The central bank buys dollars and sells foreign exchange to keep e fixed: this reduces M and shifts the LM^* curve to the left. As a result, output falls.

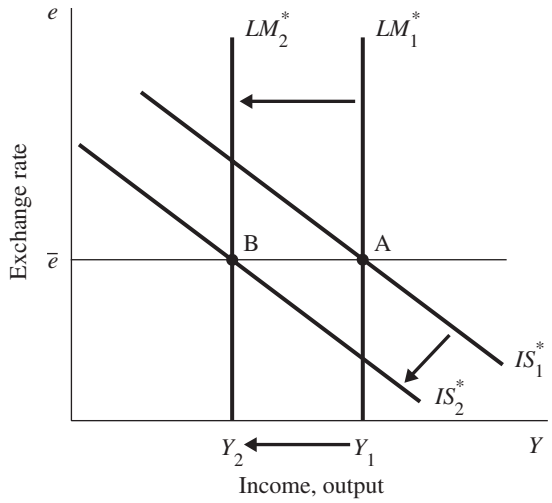


Figure 12–12

The trade balance falls, because the shift in the net exports schedule means that net exports are lower for any given level of the exchange rate.

c. The introduction of ATM machines reduces the demand for money. We know that equilibrium in the money market requires that the supply of real balances M/P must equal demand:

$$M/P = L(r^*, Y).$$

A fall in money demand means that for unchanged income and interest rates, the right-hand side of this equation falls. Since M and P are both fixed, we know that

the left-hand side of this equation cannot adjust to restore equilibrium. We also know that the interest rate is fixed at the level of the world interest rate. This means that income—the only variable that can adjust—must rise in order to increase the demand for money. That is, the LM^* curve shifts to the right.

Figure 12–13 shows the case with floating exchange rates. Income rises, the exchange rate falls (depreciates), and the trade balance rises.

Figure 12–13

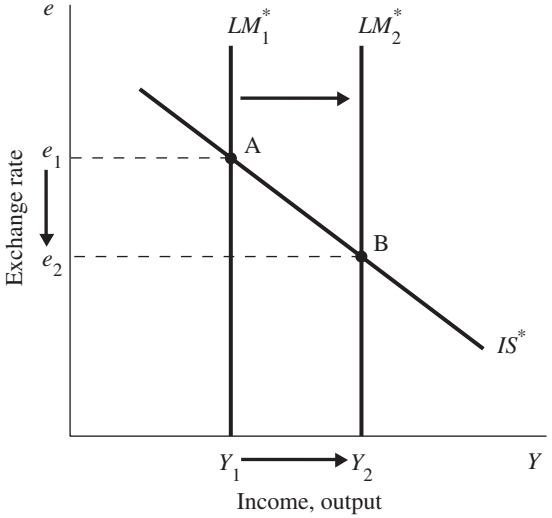
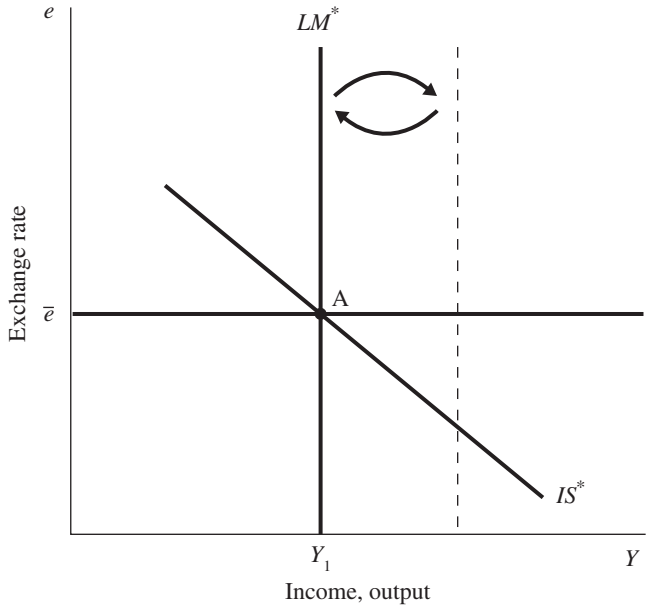


Figure 12–14 shows the case of fixed exchange rates. The LM^* schedule shifts to the right; as before, this tends to push domestic interest rates down and cause the currency to depreciate. However, the central bank buys dollars and sells foreign currency in order to keep the exchange rate from falling. This reduces the money supply and shifts the LM^* schedule back to the left. The LM^* curve continues to shift back until the original equilibrium is restored.

Figure 12–14



In the end, income, the exchange rate, and the trade balance are unchanged.

2. a. The Mundell–Fleming model takes the world interest rate r^* as an exogenous variable. However, there is no reason to expect the world interest rate to be constant. In the closed-economy model of Chapter 3, the equilibrium of saving and investment determines the real interest rate. In an open economy in the long run, the world real interest rate is the rate that equilibrates world saving and world investment demand. Anything that reduces world saving or increases world investment demand increases the world interest rate. In addition, in the short run with fixed prices, anything that increases the worldwide demand for goods or reduces the worldwide supply of money causes the world interest rate to rise.

   b. Figure 12–15 shows the effect of an increase in the world interest rate under floating exchange rates. Both the IS^* and the LM^* curves shift. The IS^* curve shifts to the left, because the higher interest rate causes investment $I(r^*)$ to fall. The LM^* curve shifts to the right because the higher interest rate reduces money demand. Since the supply of real balances M/P is fixed, the higher interest rate leads to an excess supply of real balances. To restore equilibrium in the money market, income must rise; this increases the demand for money until there is no longer an excess supply.

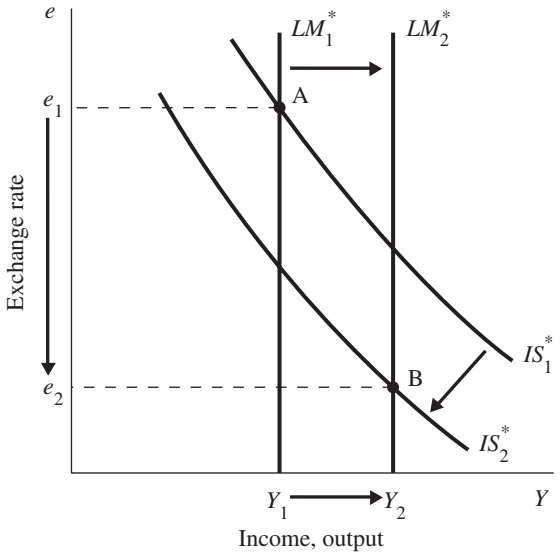


Figure 12–15

We see from the figure that output rises and the exchange rate falls (depreciates). Hence, the trade balance increases.

c. Figure 12–16 shows the effect of an increase in the world interest rate if exchange rates are fixed. Both the IS^* and LM^* curves shift. As in part (b), the IS^* curve shifts to the left since the higher interest rate causes investment demand to fall. The LM^* schedule, however, shifts to the left instead of to the right. This is because the downward pressure on the exchange rate causes the central bank to buy dollars and sell foreign exchange. This reduces the supply of money M and shifts the LM^* schedule to the left. The LM^* curve must shift all the way back to LM^*_2 in the figure, where the fixed-exchange-rate line crosses the new IS^* curve.

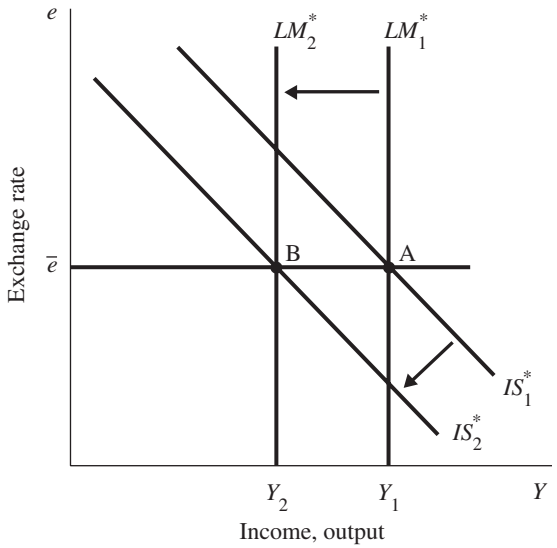


Figure 12–16

In equilibrium, output falls while the exchange rate remains unchanged. Since the exchange rate does not change, neither does the trade balance.

3. a. A depreciation of the currency makes American goods more competitive. This is because a depreciation means that the same price in dollars translates into fewer units of foreign currency. That is, in terms of foreign currency, American goods become cheaper so that foreigners buy more of them. For example, suppose the exchange rate between yen and dollars falls from 200 yen/dollar to 100 yen/dollar. If an American can of tennis balls costs $2.50, its price in yen falls from 500 yen to 250 yen. This fall in price increases the quantity of American-made tennis balls demanded in Japan. That is, American tennis balls are more competitive.

b. Consider first the case of floating exchange rates. We know that the position of the LM^* curve determines output. Hence, we know that we want to keep the money supply fixed. As shown in Figure 12–17, we want to use fiscal policy to shift the IS^* curve to the left to cause the exchange rate to fall (depreciate). We can do this by reducing government spending or increasing taxes.

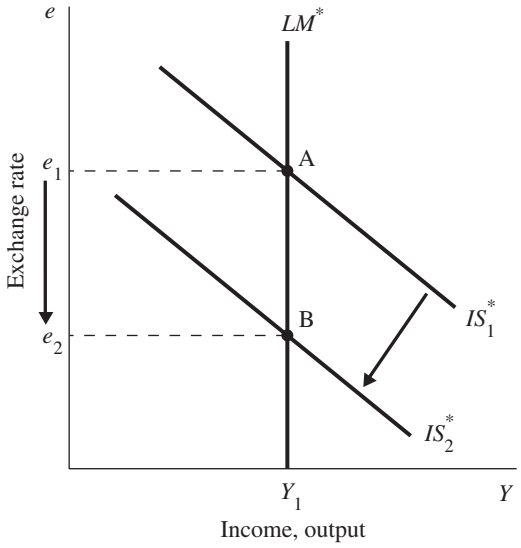


Figure 12–17

Now suppose that the exchange rate is fixed at some level. If we want to increase competitiveness, we need to reduce the exchange rate; that is, we need to fix it at a lower level. The first step is to devalue the dollar, fixing the exchange rate at the desired lower level. This increases net exports and tends to increase output, as shown in Figure 12–18. We can offset this rise in output with contractionary fiscal policy that shifts the IS^* curve to the left, as shown in the figure.

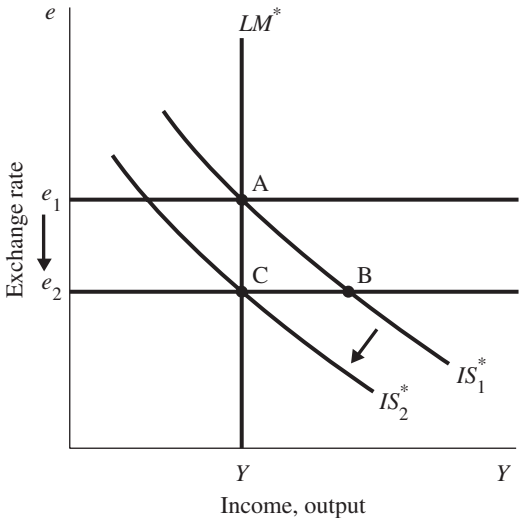


Figure 12–18

4. In the text, we assumed that net exports depend only on the exchange rate. This is analogous to the usual story in microeconomics in which the demand for any good (in this case, net exports) depends on the price of that good. The "price" of net exports is the exchange rate. However, we also expect that the demand for any good depends on income, and this may be true here as well: as income rises, we want to buy more of all goods, both domestic and imported. Hence, as income rises, imports increase, so net exports fall. Thus, we can write net exports as a function of both the exchange rate and income:

$$NX = NX(e, Y).$$

Figure 12–19 shows the net exports schedule as a function of the exchange rate. As before, the net exports schedule is downward sloping, so an increase in the exchange rate reduces net exports. We have drawn this schedule for a given level of income. If income increases from Y_1 to Y_2, the net exports schedule shifts inward from $NX(Y_1)$ to $NX(Y_2)$.

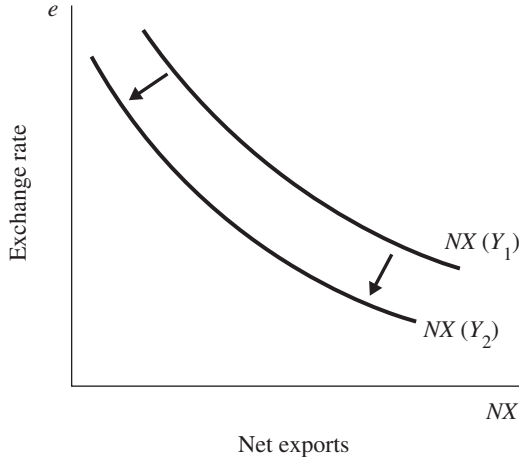


Figure 12–19

a. Figure 12–20 shows the effect of a fiscal expansion under floating exchange rates. The fiscal expansion (an increase in government expenditure or a cut in taxes) shifts the IS^* schedule to the right. But with floating exchange rates, if the LM^* curve does not change, neither does income. Since income does not change, the net-exports schedule remains at its original level $NX(Y_1)$.

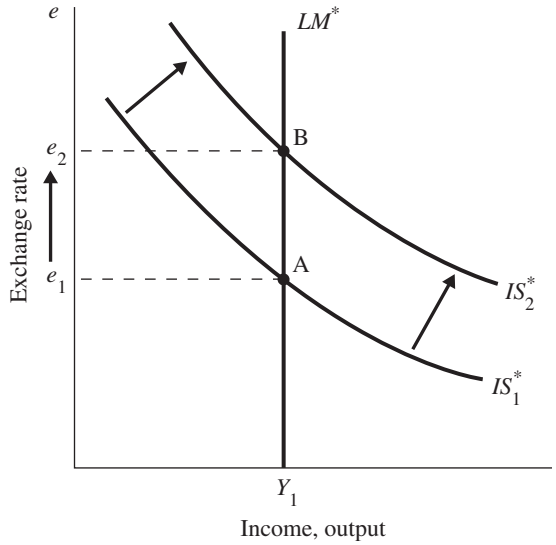


Figure 12–20

The final result is that income does not change, and the exchange rate appreciates from e_1 to e_2. Net exports fall because of the appreciation of the currency.

Thus, our answer is the same as that given in Table 12–1.

b. Figure 12–21 shows the effect of a fiscal expansion under fixed exchange rates. The fiscal expansion shifts the IS^* curve to the right, from IS^*_1 to IS^*_2. As in part (a), for unchanged real balances, this tends to push the exchange rate up. To prevent this appreciation, however, the central bank intervenes in currency markets, selling dollars and buying foreign exchange. This increases the money supply and shifts the LM^* curve to the right, from LM^*_1 to LM^*_2.

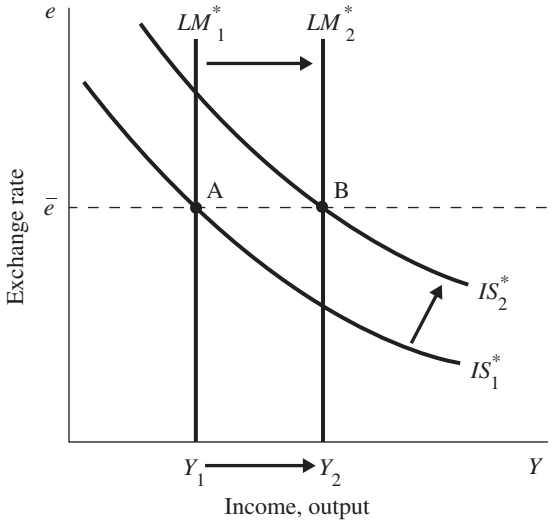


Figure 12–21

Output rises while the exchange rate remains fixed. Despite the unchanged exchange rate, the higher level of income reduces net exports because the net-exports schedule shifts inward.

Thus, our answer differs from the answer in Table 12–1 only in that under fixed exchange rates, a fiscal expansion reduces the trade balance.

5. [Note the similarity to question 7 in Chapter 11.] We want to consider the effects of a tax cut when the LM^* curve depends on disposable income instead of income:

$$M/P = L[r, Y - T].$$

A tax cut now shifts both the IS^* and the LM^* curves. Figure 12–22 shows the case of floating exchange rates. The IS^* curve shifts to the right, from IS^*_1 to IS^*_2. The LM^* curve shifts to the left, however, from LM^*_1 to LM^*_2.

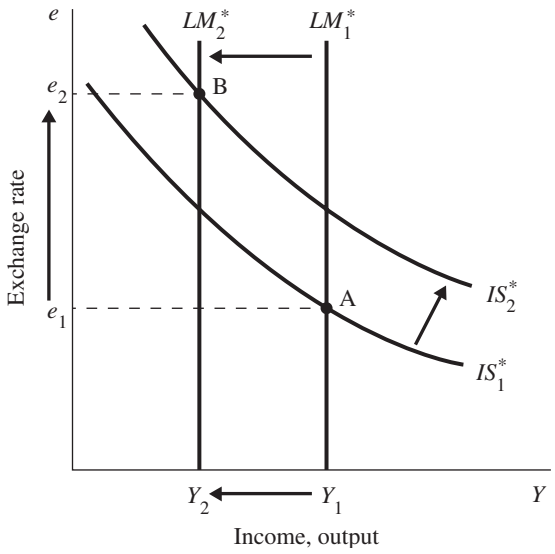


Figure 12–22

We know that real balances M/P are fixed in the short run, while the interest rate is fixed at the level of the world interest rate r^*. Disposable income is the only variable that can adjust to bring the money market into equilibrium: hence, the LM^* equation determines the level of disposable income. If taxes T fall, then income Y must also fall to keep disposable income fixed.

In Figure 12–22, we move from an original equilibrium at point A to a new equilibrium at point B. Income falls by the amount of the tax cut, and the exchange rate appreciates.

If there are fixed exchange rates, the IS^* curve still shifts to the right; but the initial shift in the LM^* curve no longer matters. That is, the upward pressure on the exchange rate causes the central bank to sell dollars and buy foreign exchange; this increases the money supply and shifts the LM^* curve to the *right*, as shown in Figure 12–23.

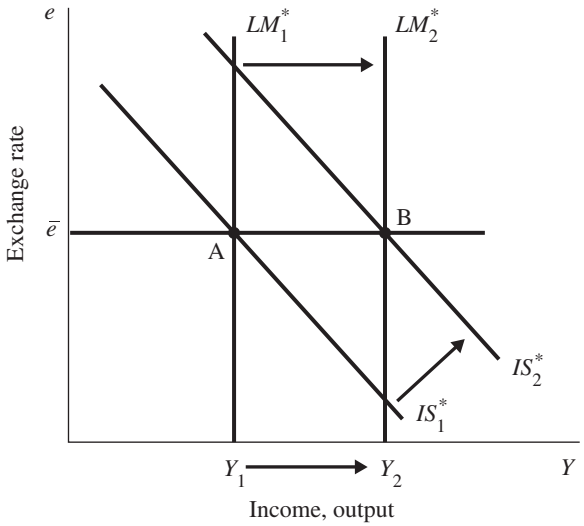


Figure 12–23

The new equilibrium, at point B, is at the intersection of the new IS^* curve, IS_2^*, and the horizontal line at the level of the fixed exchange rate. There is no difference between this case and the standard case where money demand depends on income.

6. Since people demand money balances in order to buy goods and services, it makes sense to think that the price level that is relevant is the price level of the goods and services they buy. This includes both domestic and foreign goods. But the dollar price of foreign goods depends on the exchange rate. For example, if the dollar rises from 100 yen/dollar to 150 yen/dollar, then a Japanese good that costs 300 yen falls in price from \$3 to \$2. Hence, we can write the condition for equilibrium in the money market as

$$M/P = L(r, Y),$$

where

$$P = \lambda P_d + (1 - \lambda)P_f/e.$$

a. A higher exchange rate makes foreign goods cheaper. To the extent that people consume foreign goods (a fraction $1 - \lambda$), this lowers the price level P that is relevant for the money market. This lower price level increases the supply of real balances M/P. To keep the money market in equilibrium, we require income to rise to increase money demand as well.

Hence, the LM^* curve is upward sloping.

b. In the standard Mundell–Fleming model, expansionary fiscal policy has no effect on output under floating exchange rates. As shown in Figure 12–24, this is no longer true here. A cut in taxes or an increase in government spending shifts the IS^* curve to the right, from IS^*_1 to IS^*_2. Since the LM^* curve is upward sloping, the result is an increase in output.

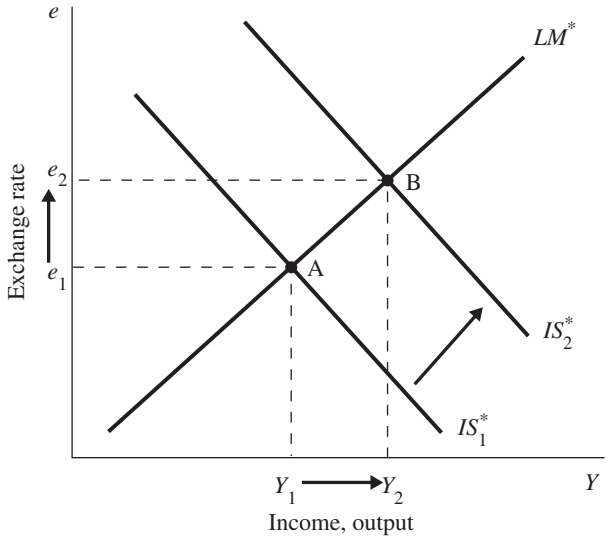


Figure 12–24

c. A central assumption in this chapter is that the price level is fixed in the short run. That is, we assumed that the short-run aggregate supply curve is horizontal at $P = \overline{P}$, as shown in Figure 12–25.

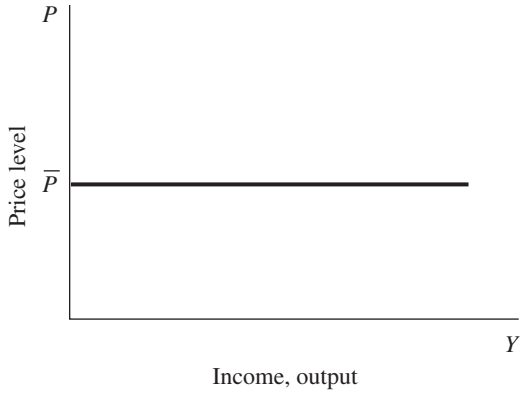


Figure 12–25

A supply shock is something that shifts the *AS* curve. If the price level *P* depends on the exchange rate, then as shown in Figure 12–26, an appreciation of the exchange rate *e* causes the price level *P* to fall—that is, the aggregate supply curve shifts down from AS_1 to AS_2. In other words, it looks exactly like a supply shock, except that the "shock" is endogenous, not exogenous.

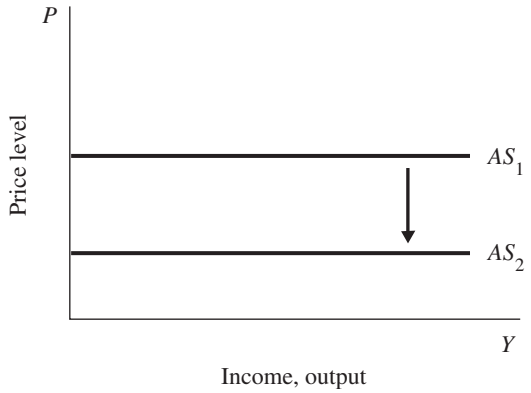


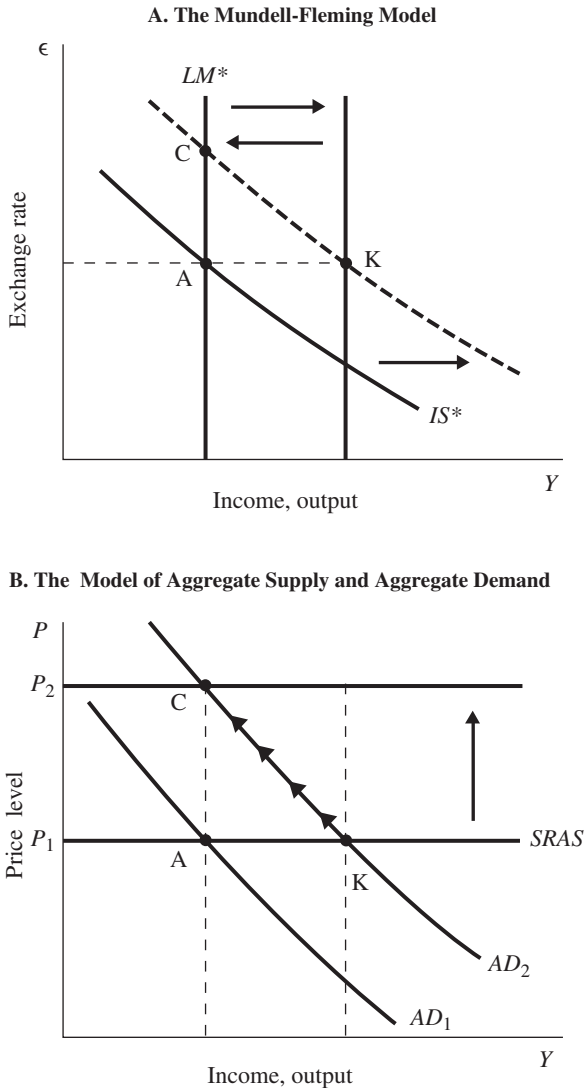
Figure 12–26

7. a. California is a small open economy, and we assume that it can print dollar bills. Its exchange rate, however, is fixed with the rest of the United States: one dollar can be exchanged for one dollar. In the Mundell–Fleming model with fixed exchange rates, California cannot use monetary policy to affect output, because this policy is already used to control the exchange rate. Hence, if California wishes to stimulate employment, it should use fiscal policy.

b. In the short run, the import prohibition shifts the IS^* curve out. This increases demand for Californian goods and puts upward pressure on the exchange rate. To counteract this, the Californian money supply increases, so the LM^* curve shifts out as well. The new short-run equilibrium is at point K in Figures 12–27(A) and (B).

Assuming that we started with the economy producing at its natural rate, the increase in demand for Californian goods tends to raise their prices. This rise in the price level lowers real money balances, shifting the short-run AS curve upward and the LM^* curve inward. Eventually, the Californian economy ends up at point C, with no change in output or the trade balance, but with a higher real exchange rate relative to Washington.

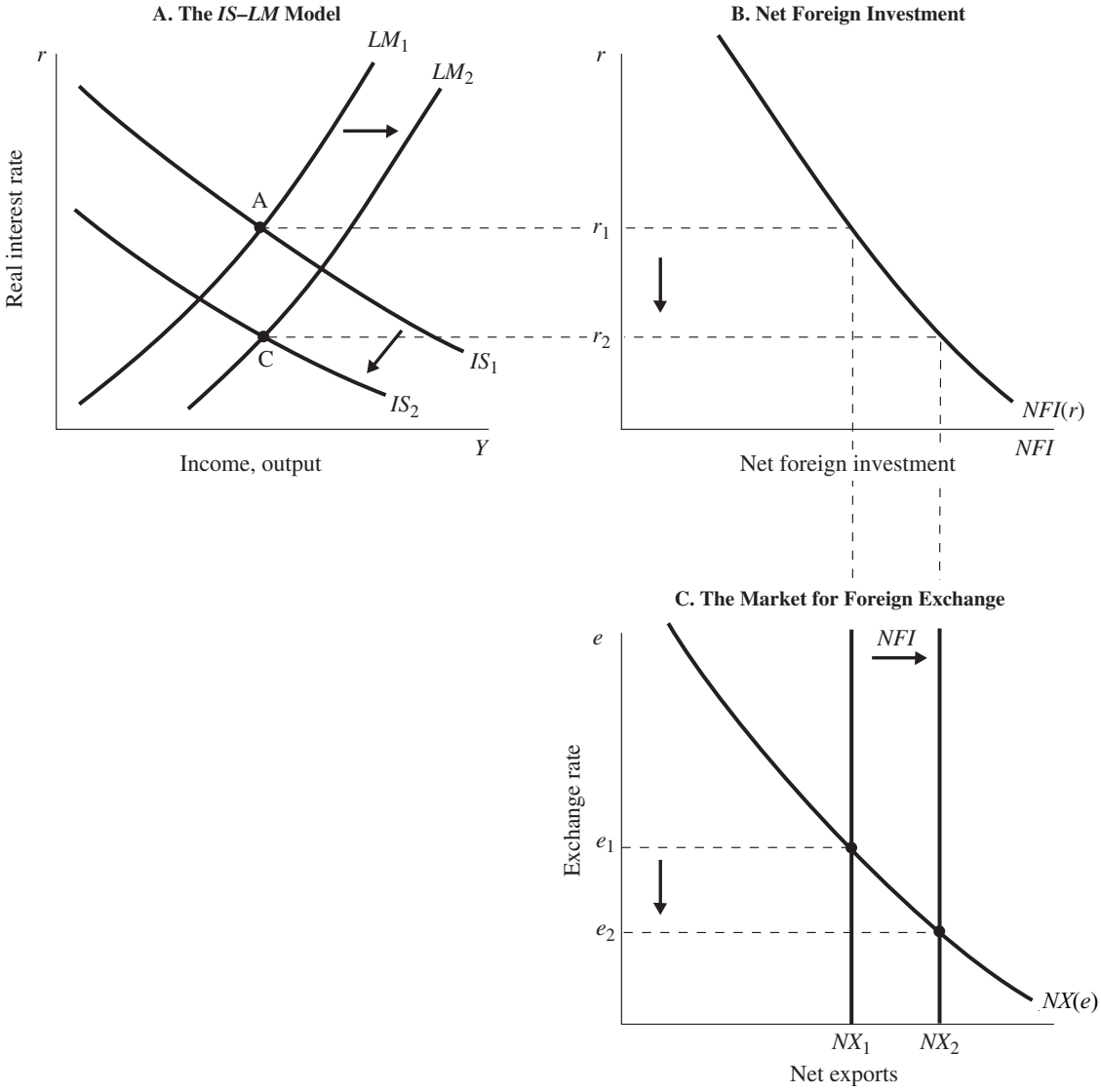
Figure 12–27



More Problems and Applications to Chapter 12

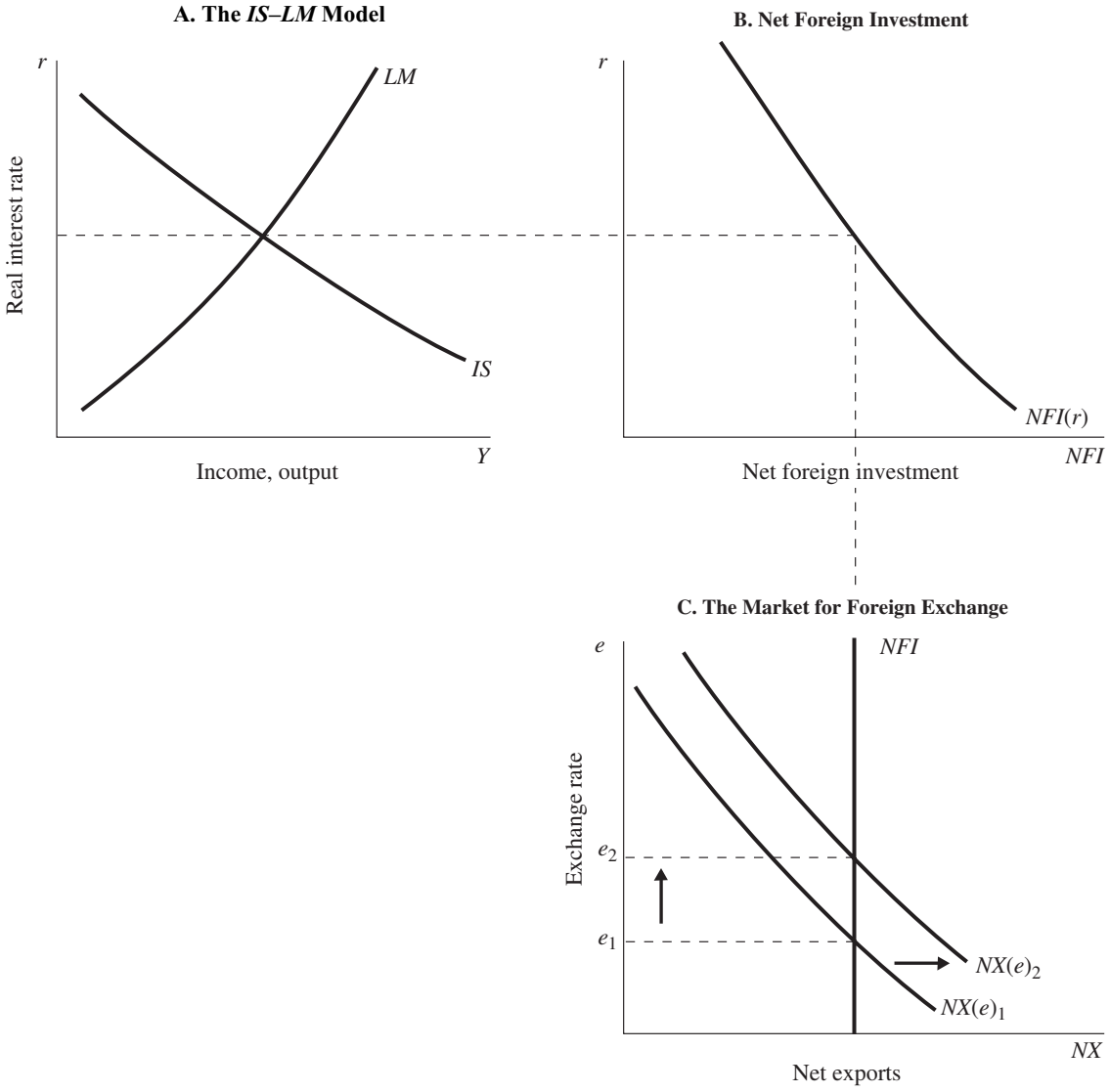
1. a. Higher taxes shift the *IS* curve inward. To keep output unchanged, the central bank must increase the money supply, shifting the *LM* curve to the right. At the new equilibrium (point C in Figure 12–28), the interest rate is lower, the exchange rate has depreciated, and the trade balance has risen.

Figure 12–28



b. Restricting the import of foreign cars shifts the $NX(e)$ schedule outward [see panel (C)]. This has no effect on either the *IS* curve or the *LM* curve, however, because the *NFI* schedule is unaffected. Hence, output doesn't change and there is no need for any change in monetary policy. As shown in Figure 12–29, interest rates and the trade balance don't change, but the exchange rate appreciates.

Figure 12–29



2. a. The *NFI* curve becomes flatter, because a small change in the interest rate now has a larger effect on capital flows.
   b. As argued in the text, a flatter *NFI* curve makes the *IS* curve flatter, as well.
   c. Figure 12–30 shows the effect of a shift in the *LM* curve for both a steep and a flat *IS* curve. It is clear that the flatter the *IS* curve is, the less effect any change in the money supply has on interest rates. Hence, the Fed has less control over the interest rate when investors are more willing to substitute foreign and domestic assets.
   d. It is clear from Figure 12–30 that the flatter the *IS* curve is, the greater effect any change in the money supply has on output. Hence, the Fed has more control over output.

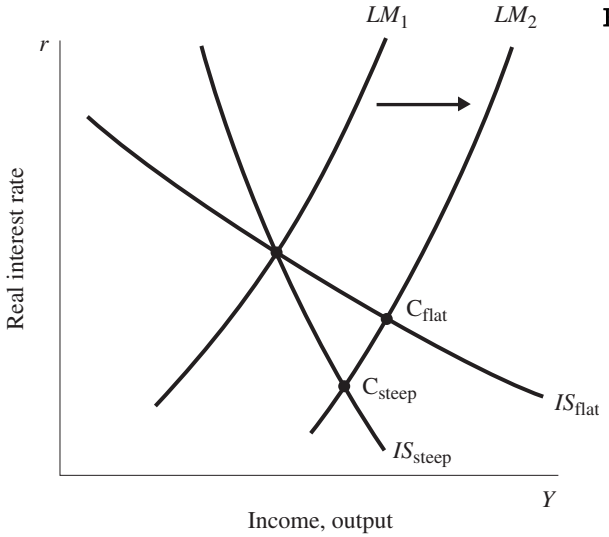
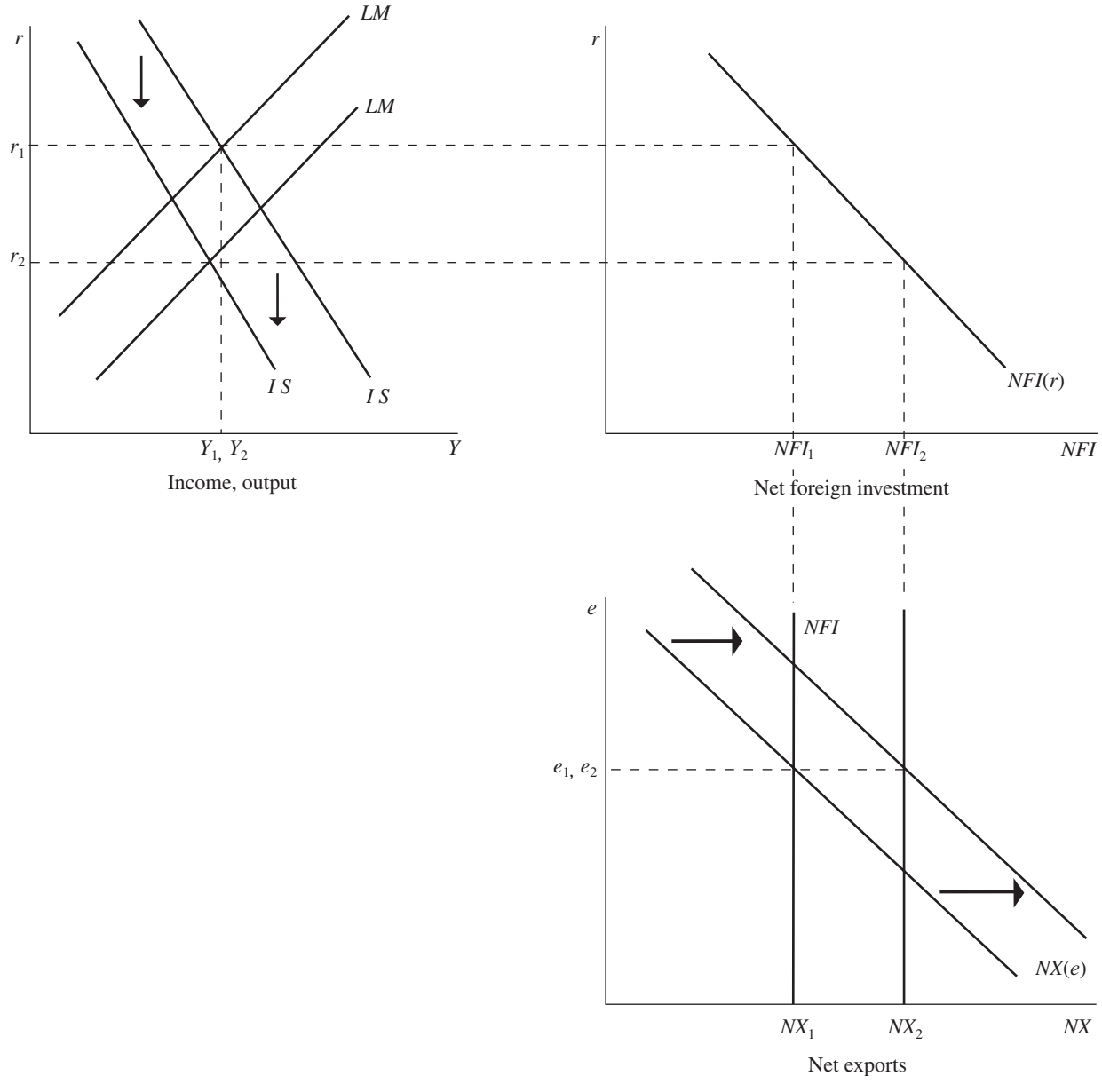


Figure 12–30

3. a. No. It is impossible to raise investment without affecting income or the exchange rate just by using monetary and fiscal policies. Investment can only be increased through a lower interest rate. Regardless of what policy is used to lower the interest rate (e.g., expansionary monetary policy and contractionary fiscal policy), net foreign investment will increase, lowering the exchange rate.

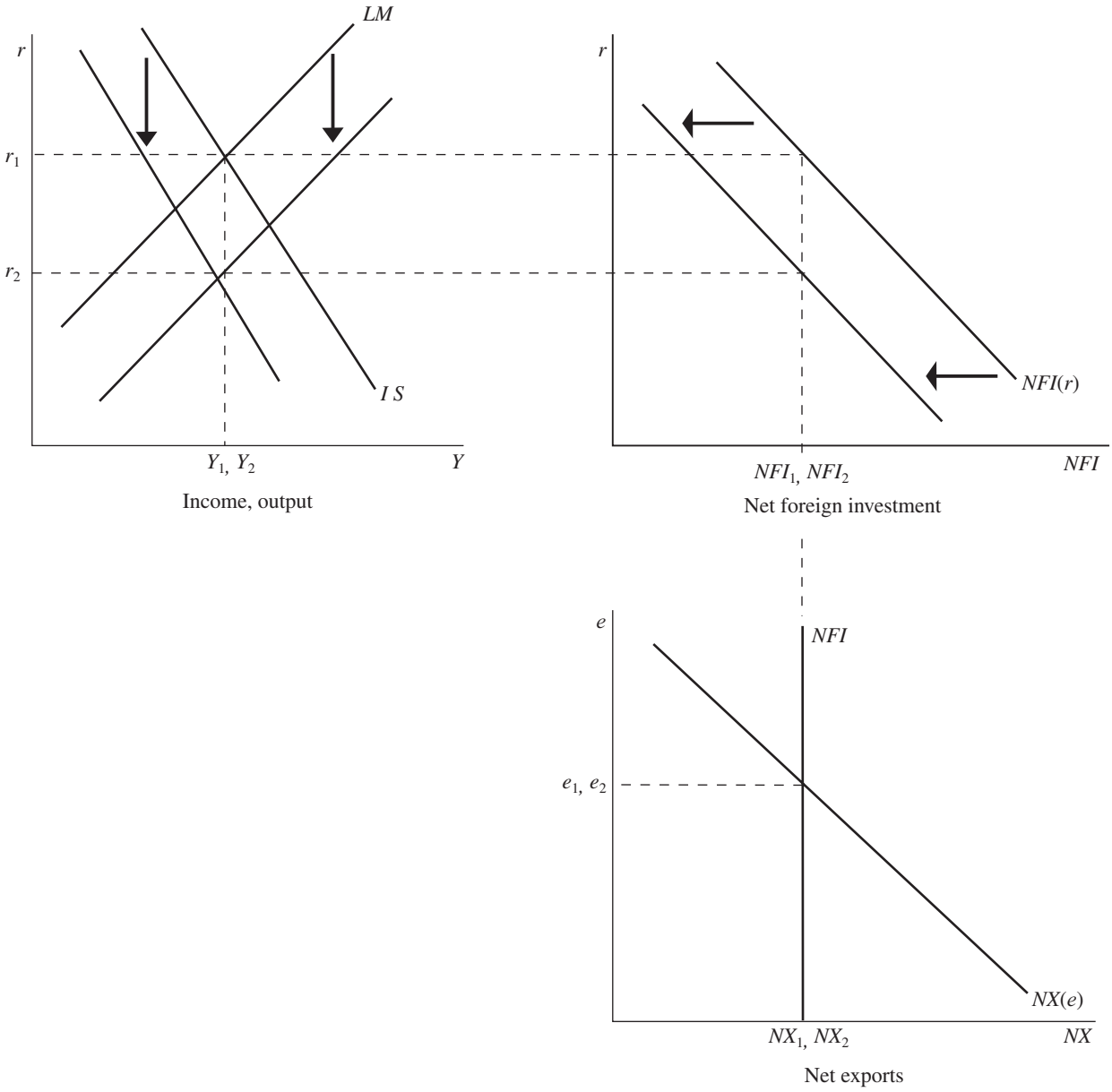
   b. Yes. Policymakers can raise investment without affecting income or the exchange rate with a combination of expansionary monetary policy and contractionary fiscal policy, and protection against imports can raise investment without affecting the other variables. Both the monetary expansion and the fiscal contraction would put downward pressure on interest rates and stimulate investment. It is necessary to combine these two policies so that their effects on income exactly offset each other. The lower interest rates will, as in part (a), increase net foreign investment, which would normally put downward pressure on the exchange rate. The protectionist policies, however, shift the net-exports curve out; this puts countervailing upward pressure on the exchange rate and offsets the effect of the fall in interest rates. Figure 12–31 shows this combination of policies.

Figure 12–31



c. Yes. Policymakers can raise investment without affecting income or the exchange rate through a home monetary expansion and fiscal contraction, combined with a lower foreign interest rate either through a foreign monetary expansion or fiscal contraction. The domestic policy lowers the interest rate, stimulating investment. The foreign policy shifts the *NFI* curve inward. Even with lower interest rates, the quantity of *NFI* would be unchanged and there would be no pressure on the exchange rate. This combination of policies is shown in Figure 12–32.

Figure 12–32

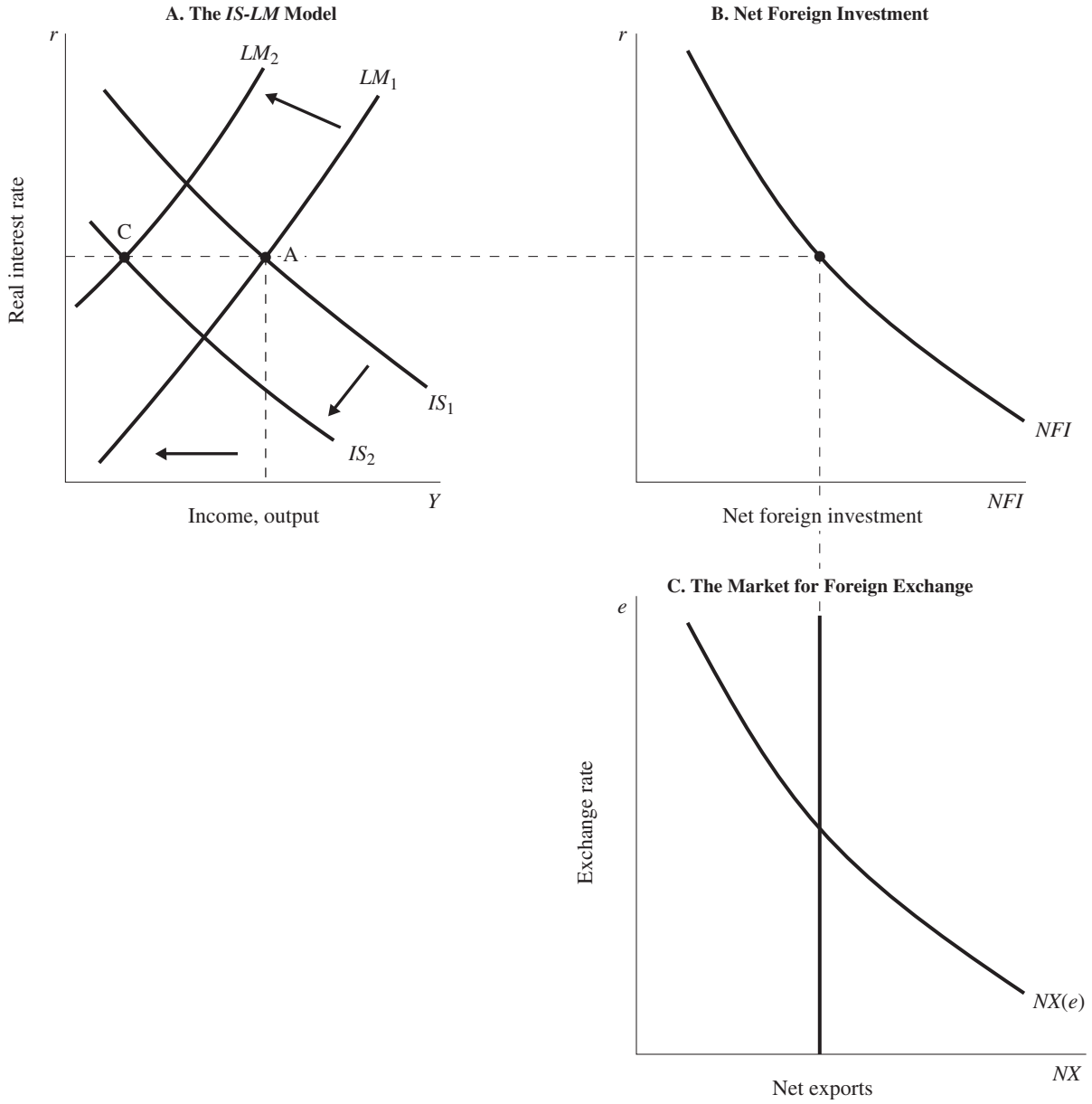


4. a. Figure 12–33 shows the effect of a fiscal contraction on a large open economy with a fixed exchange rate. The fiscal contraction shifts the *IS* curve to the left in panel

(A), which puts downward pressure on the interest rate. This tends to increase *NFI* and cause the exchange rate to depreciate [see panels (B) and (C)]. To avoid this, the central bank intervenes and buys dollars. This keeps the exchange rate from depreciating; it also shifts the *LM* curve to the left. The new equilibrium, at point C, has an unchanged interest rate and exchange rate, but lower output.

This effect is the same as in a small open economy.

Figure 12–33



b. A monetary expansion tends to shift the *LM* curve to the right, lowering the interest rate [panel (A) in Figure 12–34]. This tends to increase *NFI* and cause the exchange rate to depreciate [see panels (B) and (C)]. To avoid this depreciation, the central bank must buy its currency and sell foreign exchange. This reduces the money supply and shifts the *LM* curve back to its original position. As in the model of a small open economy, monetary policy is ineffectual under a fixed exchange rate.

Figure 12–34